

Roundabouts

A roundabout is a circular intersection that maneuvers traffic around in a counterclockwise direction so that cars make a right-hand turn onto a desired street¹. Vehicles from approaching streets are generally not required to stop although approaching vehicles are required to yield to motorists in the roundabout. It is believed that this system eliminates certain types of crashes at traditional intersections.

Roundabout design can become quite problematic in dealing with pedestrian and bicycle use. Every effort must be made to prompt motorists to yield to pedestrians crossing the roundabout. A low design speed is required to improve pedestrian safety. Splitter islands and single lane approaches both lend to pedestrian safety as well as other urban design elements discussed in this chapter.

Problems also arise with the vision-impaired because there are not proper audible cues associated with when to cross. Studies are underway to develop and test solutions. Auditory accessible pedestrian signals placed on sidewalks and splitter islands are one solution, but again there is no research to prove their efficacy¹.

In areas where traffic is low, a roundabout presents little in the way of a barrier for bicyclists. However, in multi-lane roundabouts where speeds are higher, and the traffic is heavy, bicyclists are at a distinct and dangerous disadvantage. Adding a bike lane within such a roundabout has not proven to be effective. A possible solution involves creating a bike lane that completely skirts the roundabout allowing the cyclist to use or share the pedestrian route.

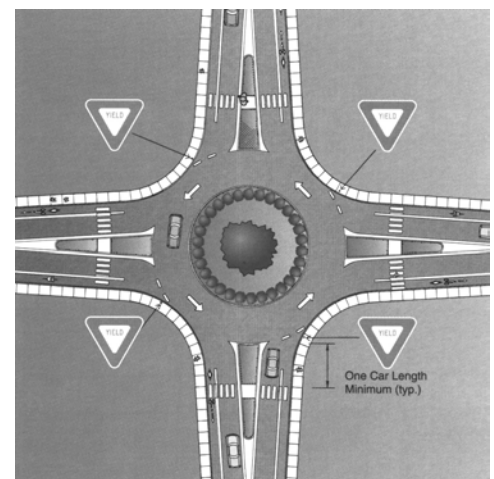


Figure 6(q):
Typical roundabout.³

Guidelines¹¹:

- The recommended maximum entry design speed for roundabouts ranges from 15 mph for 'mini-roundabouts' in neighborhood settings, to 20 mph for single-lane roundabouts in urban settings, to 25 mph for single-lane roundabouts in rural settings.
- Refer to roundabout diagram for typical crosswalk placement.
- Please refer to FHWA's report, Roundabouts, an Information Guide, available online through: www.tfhrc.gov The report provides information on general design principles, geometric elements, and provides detailed specifications for the various types of roundabouts.

Cost¹:

Neighborhood intersection, landscaped:	\$45,000 - \$150,000
Arterial, landscaped	\$250,000
Lower maintenance cost than traditional signals	

Signalization**Traffic Signals**

Figure 6(r):
International symbols used in a crosswalk
to designate WALK and DON'T WALK¹.

Traffic signals assign the right of way to motorists and pedestrians and produce openings in traffic flow, allowing pedestrians time to cross the street¹⁴. When used in conjunction with pedestrian friendly design, proper signalization should allow for an adequate amount of time for an individual to cross the street. The suggested amount of pedestrian travel speed recommended in the Manual on Uniform Traffic Control Devices (MUTCD) is 4ft/sec however this does not address the walking speed of the elderly or children. Therefore it is suggested that a lower speed of 3.5ft/sec be used whenever there are adequate numbers of elderly and children using an area.

Engineering, as well as urban design judgment, must be used when determining the location of traffic signals and the accompanying timing intervals. Although warrants for pedestrian signal timing have been produced by the MUTCD, each site must be analyzed for factors including new facility and amenity construction (i.e. a popular new park or museum) to allow for potential future pedestrian traffic volume. In addition, creating better access to existing places may in fact generate a higher pedestrian volume¹.

Fixed timed sequencing is often used in high traffic volume commercial or downtown areas to allow for a greater efficiency of traffic flow. In such instances, the pedestrian speed must be carefully checked to ensure safety.

Pedestrian Signals

There are a host of possible traffic signal enhancement opportunities that can greatly improve the safety and flow of

pedestrian traffic. Some include: international symbols for WALK and DON'T WALK, providing large traffic signals, the positioning of traffic signals so that those waiting at a red-light cannot see the opposing traffic signal and anticipate their own green-light, installing countdown signals to provide pedestrians information on how long they have remaining in the crossing interval, automatic pedestrian sensors, and selecting the proper signal timing intervals¹.

According to the MUTCD, international pedestrian signal indication should be used at traffic signals whenever warranted¹. As opposed to early signalization that featured “WALK” and “DON'T WALK”, international pedestrian symbols should be used on all new traffic signal installations as illustrated in Figure 6(r). Existing “WALK” and “DON'T WALK” signals should be replaced with international symbols when they reach the end of their useful life.

Symbols should be of adequate size, clearly visible, and, in some circumstances, accompanied by an audible pulse or other messages to make crossing safe for all pedestrians. Consideration should be paid to the noise impact on the surrounding neighborhoods when deciding to use audible signals¹. For additional information on accessible pedestrian signals, please visit: www.walkinginfo.org/aps.

Audible cues can also be used to pulse along with a countdown signal. Countdown signals are pedestrian signals that show how many seconds the pedestrian has remaining to cross the street. The countdown can begin at the beginning of the WALK phase, perhaps flashing white or yellow, or at the beginning of the clearance, or DON'T WALK phase, flashing yellow as it counts down.

The timing of these or other pedestrian signals needs to be adapted to a given situation. There are three types of signal timing generally used: *concurrent*, *exclusive*, and *leading pedestrian interval* (LPI). The strengths and weaknesses of each will be discussed with an emphasis on when they are best employed.

Concurrent signal timing refers to a situation where motorists



Figure 6(s):
Audible cues can be used along with a count-
down signal for pedestrians.

running parallel to the crosswalk are allowed to turn into and through the crosswalk, left or right, after yielding to pedestrians. This condition is not considered as safe as some of the latter options, however this type of signal crossings generally allows for more pedestrian crossing opportunities and less wait time. In addition, traffic is allowed to flow a bit more freely. *Concurrent* signal timing is best used where lower volume turning movements exist¹.

Where there are high-volume turning situations that conflict with pedestrian movements, the *exclusive* pedestrian interval is the preferred solution. The *exclusive* pedestrian intervals stop traffic in all directions. In order to keep traffic flowing regularly, there is often a greater pedestrian wait time associated with this system. Although it has been shown that pedestrian crashes have been reduced by 50% in some commercial or downtown areas by using these intervals, the long wait times can encourage some to attempt a cross when there is a perceived lull in traffic¹. These types of crossings are dangerous and may negate the use of the system. A problem is also created for those with visual impairments when the audible cues of the passing parallel traffic is eliminated. Often an audible signal will have to accompany a WALK signal¹.

A proven enhancement that prevents many of the conflicts addressed under either of the former methods is LPI. An LPI works in conjunction with a *concurrent* signal timing system and simply gives the pedestrian a few seconds head start on the parallel traffic. An advance walk signal is received prior to a green light for motorists. This creates a situation where the pedestrian can better see traffic, and more importantly, the motorists can see and properly yield to pedestrians¹. Long-term research has shown that this system has worked well in places like New York City (where it has been used for 20 years) at reducing motorist and pedestrian conflict¹. As with the *exclusive* pedestrian interval, an audible cue will need to accompany the WALK signal for the visually impaired.

The use of infrared or microwave pedestrian detectors has increased in many cities worldwide. These devices replace the traditional push-button system. Although still experimental, they appear to be improving pedestrian signal compliance as

well as reducing the number of pedestrian and vehicle conflicts¹. Perhaps the best use of these devices is when they are employed to extend crossing time for slower moving pedestrians. Whether these devices are used or the traditional push-button system is employed, it is best to provide instant feedback to pedestrians regarding the length of their wait. This is thought to increase and improve pedestrian signal compliance.

Guidelines^{3,9}:

- Pedestrian signals should be placed in locations that are clearly visible to all pedestrians.
- Larger pedestrian signals should be utilized on wider roadways, to ensure readability.
- Pedestrian signal pushbuttons should be well-signed and visible.
- Pedestrian signal pushbuttons should clearly indicate which crossing direction they control.
- Pedestrian signal pushbuttons should be reachable from a flat surface, at a maximum height of 3.5 feet and be located on a level landing to ensure ease of operation by pedestrians in wheelchairs.
- Walk intervals should be provided during every cycle, especially in high pedestrian traffic areas.

Cost¹:

Traffic signals:	\$20,000 - \$140,000
Pedestrian signals:	\$5,000
Adjusting signal timing requires a few hours of staff time	

Right Turn on Red Restrictions

Introduced in the 1970's as a fuel saving technique, the *Right Turn on Red* (RTOR) law is thought to have had a detrimental effect on pedestrians¹. The issue is not the law itself but rather the relaxed enforcement of certain caveats within the law such as coming to a complete stop and yielding to pedestrians. Often motorists will either nudge into a crosswalk to check for oncoming traffic without looking for pedestrians or slow, but not stop, for the red-light while making the turn.

There is legitimate concern that eliminating an RTOR will only increase the number of right-turn-on-green conflicts where all of the drivers who would normally have turned on red, now are anxious to turn on green. As discussed in the prior section, LPI or



Figure 6(t):
A low cost sign that restricts right-hand turns at a red light⁴.

exclusive pedestrian intervals may help to alleviate this problem. Eliminating RTOR should be considered on a case-by-case basis and only where there are high pedestrian volumes. This can be done by simple sign postings as illustrated in Figure 6(o).

Cost¹:

Signage, installed: \$230 - \$350

Landscaping

The introduction of vegetation in an urban environment can provide a welcomed intervention of nature into a place that is otherwise hardened from buildings, concrete, and asphalt. It can be used to provide a separation buffer between pedestrians and motorists, reduce the width of a roadway, calm traffic by creating a visual narrowing of the roadway, enhance the street environment, and help to generate a desired aesthetic.



*Figure 6(u):
Landscaping used on the Sea Street in
Seattle, Washington shows how stormwater
treatment can be tied to aesthetically
pleasing plantings⁷.*

Street trees and other plantings provide comfort, a sense of place, and a more natural and inviting setting for pedestrians. Landscaping and the aforementioned street furniture make people feel welcome.

There are also some instances where islands of vegetation are created to collect and filter stormwater from nearby streets and

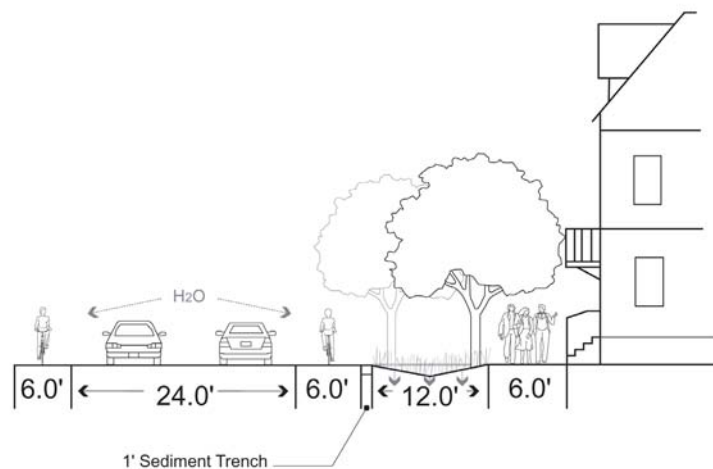


Figure 6(v):

A bioswale can also be used as a vegetated buffer for pedestrians while reinforcing the idea of corridors functioning as their own special event.

buildings. These islands are referred to as constructed wetlands, rain gardens, and/or bioswales. When these devices are employed, the benefits listed above are coupled with economic and ecologic benefits of treating stormwater at its source. There are many examples of this in Oregon and Washington, particularly Seattle's Green Streets Program. Using thoughtful design to treat stormwater as an amenity rather than waste to be disposed of in an environmentally harmful manner is gaining popularity nationwide.

An issue with this or any landscaping treatment is that of ongoing maintenance. The responsibility often falls on local municipalities although there are instances where local community groups have provided funding and volunteers for maintenance. The best way to address the maintenance issue is to design using native plant material that is already adapted to the local soil and climate. Growth pattern and space for maturation, particularly with larger tree plantings, are important to avoid cracking sidewalks and other pedestrian obstructions.

Guidelines³:

- Buffer zone plantings should be maintained at no higher than three feet to allow sight distance for motorists and pedestrians.
- Trees with large canopies planted between the sidewalk and street should generally be trimmed to keep branches at least seven feet above the sidewalk.
- Plants and trees should be chosen to match character of area.

Cost¹:

Varies greatly. May be supplemented by funds from community organizations or homeowners associations.

Roadway Lighting Improvements

Proper lighting in terms of quality, placement, and sufficiency can greatly enhance a nighttime urban experience as well as create a safe environment for motorists and pedestrians. Two-thirds of all pedestrian fatalities occur during low-light conditions³. Attention should be paid to crossings so that there is sufficient ambience for motorists to see pedestrians. To be most effective, lighting should be consistent, adequately spaced, and distinguished, providing adequate light.



*Figure 6(w):
Street trees buffer and soften often harsh urban environments in a number of psychological, physical, and ecological ways¹⁰.*